# GILL DAMAGE IN FISH PRODUCED BY BUCCAL PARASITES

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*Abstract*. The buccal parasites *Codonophilus imbricatus* (Fabricius) and *Irona melanosticta* Schiodte & Meinert (Isopoda : Cymothoidae), were found to cause gill damage in fish through the abrasive action of peraeopods on gill lamellae, and, by virtue of gross size, to physically limit the inward growth of gill rakers. Gill damage is considered more permanent than superficial skin erosion and has been found a useful guide to previous parasitism after the parasite is removed or lost.

Skin damage in fish, caused by some cymothoid ectoparasites, has been related to parasite feeding activities (Hale 1926, Bowman & Mariscal 1968) but, because damage is superficial, fairly rapid healing should occur once the parasite is removed. In contrast the erosion of gill lamellae, Bowman (1960), Turner & Roe (1967), and operculum abrasion Briggs (1970), by parasites have a physical origin and are not consequential of feeding. Because hard tissues are involved these conditions may persist for some time after the parasite is lost.

In studies of New Zealand jack mackerels *Trachurus* spp. and the garfish *Hyporohamphus ihi* (Phillipps), it was found, after the removal of their respective buccal parasites *Codonophilus imbricatus* (Fabricius) and *Irona melanosticta* Schiodte & Meinert (Isopoda : Cymothoidae), that in addition to the erosion of gill lamellae, the inward growth of gill rakers had been displaced. In some older fish a callus-like tissue had formed over the ventral bucco-pharynx. It is considered that the gross size and shape of parasites acts as a physical irritant to the bucco-branchial tissues, and is responsible for the observed damage.

Samples of the fishes *Trachurus declivis* (Jenyns), *T. novaezelandiae* (Richardson) and *Hyporohamphus ihi* were collected for previous studies (Stephenson unpublished 1971, Stephenson & Robertson in press) from various coastal localities. Individual fish were measured for standard length (SL), after Hubbs & Lagler (1947) and examined for the presence or absence of isopods. Juvenile and male parasites were found over the gill surfaces, but prospective and mature females occupy a bucco-pharyngeal position grasping the cartilagenous tongue (glossohyal) and always facing towards the mouth opening. Isopods were extracted and preserved separately to avoid subsequent handling losses; sufficient data being recorded to ensure a future cross-reference between parasites and their host.

Gill damage was noted while taking standard gill raker counts from dissected first gill arch, usually left side, of each fish. Observations were made with the aid of a steroscopic microscope and where additional clarity was required the material was briefly stained in alkaline Alizarin — Red S.

*Rec. Auckland Inst. Mus.* 13: 167-173 December 10th, 1976

Fig. 1. *Trachurus novaezelandiae* SL 10.9 cm. Inner face of undamaged first gill arch; parasite absent.

Fig. 2. *Hyporohamphus ihi*. SL 19.1 cm. Outer face of undamaged first gill arch; parasite absent.

Fig. 3. *Trachurus novaezelandiae*. SL 8.7 cm. Damaged inner face of first gill arch; parasite present.

Fig. 4. *Hyporohamphus ihi*. SL 16.5 cm. Damaged inner face of first gill arch; parasite present.

*Results*

The undamaged appearance of the first gill arch is shown respectively for *Trachurus novaezelandiae* (Fig. 1) and *Hyporohamphus ihi* (Fig. 2). They are characterised by a regularity in distribution and profile of gill rakers and lamellae along the branchial arch. In both genera gill rakers are narrowly lanceolate; sparingly bristled along inner borders. Total gill raker counts along the first gill arch are mostly in the range 49-59 for *Trachurus novaezelandiae* and 47-57 for *T. declivis* (Stephenson & Robertson in press). In *Hyporohamphus ihi* it is usually 28-30 (Collette 1974). Although rakers often appeared to be more widely spaced in parasitised fish their raker counts are not significantly different from uninfected individuals (Table 1).

Gill damage was intimately linked with parasites collected from the buccal cavity or the branchial arches. The degree of damage, however, was variable in nature and intensity but did not appear to be species related. Amongst the general conditions observed were the erosion of gill lamellae, the disruption and stunted growth of gill rakers (Figs. 3, 4), and a callus-like thickening (dystrophic calcification) over inner edges of the gill rakers and branchial arch (Fig. 5). The transitional nature of the damage made it impracticable to categorise these conditions.

Some large jack mackerel (above 35.0 cm, SL) showed raker damage of a quite different type (Fig. 6) where only the raker tips are thickened or bent, and occasional rakers were bifurcate. This could not be directly linked with previous parasitism, there being no parasites amongst the fish examined (Table 1) or recorded from the total catch (D. R. Robertson pers. comm.).

*Discussion*

The extent of gill damage may reflect the duration of infection since eroded gill lamellae were noticed more frequently in very young fish, while stunted rakers and callus formation appeared confined to fish usually from 2-5 yr. old. There are, however, difficulties in interpretation. Some large buccal parasites were found with their anterior peraeopods grasping through the gill arch and in contact with lamellae. Gill lamellae are also the sites of attachment for juveniles and males. In both cases lamellae damage could be sustained in older fish.

During early years of a host's life it appears probable that physical contact between a buccal parasite and the host's gill rakers would be more or less continual. In addition movements of the hyoid apparatus in gill ventilation and food swallowing would create frictional irritation between these surfaces. This feature is regarded as the main cause of gill damage recognised in this report.

Because gill raker damage involves the alteration in shape of hard tissue it may, on its own, be a useful guide to previous buccal isopod parasitism. This has been found practical, at least in the short term, where parasites often crawl or dislodge from their hosts during capture and examination.

Fig. 5. *Trachurus declivis*. SL 13.1 cm. Advanced damage to inner face of first gill arch; parasite present.

Fig. 6. *Trachurus declivis*. SL 44.0 cm. Raker tip anomaly, viewed from inner face of first gill arch; parasite absent.

Table 1. Length and gill condition of fish examined for isopod parasites.

| Species | Standard Length cm | Gill raker count | Parasite present | Parasite absent | Gill damage present | Gill damage absent |
|---|---|---|---|---|---|---|
| *Trachurus declivis* | 3.5 | 11 + 31 | X | | X | |
| | 4.1 | 11 + 32 | X | | X | |
| | 4.2 | 11 + 36 | X | | X | |
| | 4.5 | 12 + 34 | X | | X | |
| | 4.5 | 12 + 32 | X | | X | |
| | 4.7 | 11 + 36 | X | | X | |
| | 5.0 | 14 + 36 | | X | | X |
| | 5.1 | 12 + 36 | | X | | X |
| | 8.7 | 14 + 37 | | X | | X |
| | 13.6 | 13 + 41 | X | | X | |
| | 13.8 | 13 + 38 | X | | X | |
| | 14.1 | 14 + 40 | | X | | X |
| | 15.2 | 14 + 39 | | X | | X |
| | 15.3 | 14 + 42 | | X | | X |
| | 15.5 | 14 + 40 | | X | | X |
| | 16.0 | 13 + 40 | | X | | X |
| | 16.1 | 13 + 39 | | X | | X |
| | 16.2 | 14 + 39 | | X | X | |
| | 17.5 | 15 + 40 | X | | X | |
| | 17.7 | 15 + 40 | X | | X | |
| | 18.0 | 13 + 40 | | X | X | |
| | 18.2 | 15 + 41 | | X | | X |
| | 18.5 | 14 + 40 | X | | X | |
| | 19.5 | 15 + 41 | | X | | X |
| | 20.6 | 14 + 40 | | X | | X |
| | 32.0 | 14 + 41 | | X | | X |
| | 33.0 | 14 + 38 | | X | X | |
| | 43.5 | 14 + 40 | | X | | X |
| | 43.5 | 14 + 37 | | X | | X |
| | 44.0 | 15 + 39 | | X | X | |
| | 44.0 | 14 + 37 | | X | X | |
| | 45.0 | 15 + 37 | | X | | X |
| | 45.0 | 14 + 40 | | X | | X |
| | 45.5 | 14 + 36 | | X | | X |
| | 46.0 | 14 + 39 | | X | | X |
| | 46.0 | 15 + 38 | | X | X | |
| | 46.5 | 14 + 38 | | X | | X |
| | 47.0 | 14 + 38 | | X | | X |
| *Trachurus novaezelandiae* | 5.6 | 15 + 38 | | X | | X |
| | 7.0 | 14 + 40 | X | | X | |
| | 8.3 | 14 + 38 | X | | X | |
| | 8.3 | 15 + 40 | | X | | X |
| | 8.4 | 15 + 42 | | X | | X |
| | 8.7 | 15 + 39 | X | | X | |
| | 9.5 | 14 + 38 | | X | | X |
| | 9.6 | 14 + 40 | | X | | X |
| | 9.9 | 14 + 42 | | X | | X |
| | 10.2 | 10 + 41 | | X | | X |
| | 10.6 | 14 + 41 | X | | X | |
| | 10.7 | 15 + 38 | X | | X | |
| | 10.9 | 14 + 39 | | X | X | |
| | 11.7 | 14 + 42 | X | | X | |
| | 12.6 | 15 + 39 | | X | X | |
| | 13.1 | 14 + 42 | X | | X | |
| | 13.2 | 15 + 40 | | X | X | |
| | 16.8 | 14 + 42 | | X | | X |
| | 17.7 | 14 + 42 | | X | | X |
| | 19.4 | 14 + 39 | | X | | X |
| | 20.2 | 14 + 42 | | X | | X |
| | 22.5 | 15 + 39 | X | | X | |
| | 23.5 | 14 + 39 | | X | | X |

| Species | Standard Length cm | Gill raker count | Parasite present | Parasite absent | Gill damage present | Gill damage absent |
|---|---|---|---|---|---|---|
| *Hyporohamphus ihi* | 11.3 | 8 + 20 | X | | X | |
| | 12.0 | 9 + 20 | | X | | X |
| | 12.2 | 7 + 19 | | X | | X |
| | 12.3 | 9 + 20 | X | | X | |
| | 13.0 | 9 + 19 | X | | X | |
| | 13.3 | 6 + 19 | X | | X | |
| | 14.4 | 8 + 20 | X | | X | |
| | 14.4 | 8 + 20 | X | | X | |
| | 14.9 | 8 + 20 | X | | X | |
| | 15.9 | 7 + 20 | | X | | X |
| | 16.2 | 7 + 20 | X | | X | |
| | 16.5 | 8 + 19 | X | | X | |
| | 16.5 | 7 + 20 | X | | X | |
| | 17.6 | 8 + 19 | X | | X | |
| | 18.3 | 7 + 21 | X | | X | |
| | 18.8 | 7 + 21 | X | | X | |
| | 19.1 | 9 + 21 | | X | | X |
| | 21.5 | 9 + 19 | X | | X | |

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